

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-174667

(43)Date of publication of application : 23.06.2000

(51)Int.Cl.

H04B 1/713

H04B 1/04

H04B 1/16

(21)Application number : 10-345861

(71)Applicant : JAPAN RADIO CO LTD

(22)Date of filing : 04.12.1998

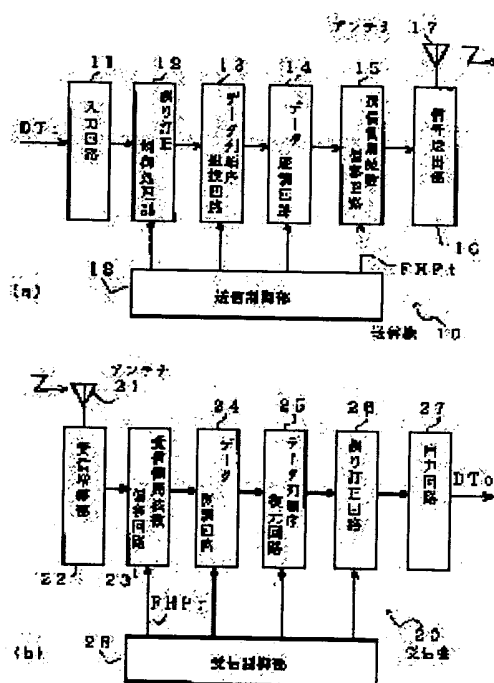
(72)Inventor : TAGUCHI KEIICHI

(54) FREQUENCY HOPPING TRANSMISSION SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To improve the reproducibility of data even when interference is present and to accurately transmit information in the case that a data transfer speed is high or in the case of wanting to accelerate the data transfer rate.

SOLUTION: In this transmission system, a transmitter 10 is provided with a data string order rearrangement circuit 13 for rearranging the order of data strings outputted from an error correction control processing part 12 so as to distribute the successive data of the same number as the number of hopping frequencies used in the system of the data strings to the mutually different hopping frequencies and outputting them to a data modulation circuit 14. Then, a receiver 20 is provided with a data string order restoration circuit 25 for restoring the order of the data strings from a data demodulation circuit 24 and outputting them to an error correction circuit 26.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The frequency-hopping transmission system which is a frequency-hopping transmission system which the hopping frequency from which plurality differs according to the hopping pattern which was able to be defined beforehand is made to deviate the frequency of the signal which carries out data transmission one by one, and carries out data transmission to it, and is characterized by having each following composition.

Transmission characterized by providing the following. (b) The error correction control processing section which performs and outputs error correction control processing of the transmitting side beforehand defined to the inputted data stream. The data stream sequence recombination circuit which rearranges and outputs the sequence of the data stream outputted from this error correction control processing section so that it may be distributed to the hopping frequency from which the data with which the number of hopping frequency with which these data streams differ the account of before, and the same number continue differ mutually. The data modulation circuit which generates the transmitted intermediate frequency signal modulated by the output data of this data stream sequence recombination circuit. The frequency of the aforementioned transmitted intermediate frequency signal It lets the frequency-hopping signal generation sending-out section machine (b) aforementioned data transmission line which two or more aforementioned hopping frequency is deviated one by one according to the aforementioned hopping pattern, generates a frequency-hopping signal, and is sent out to the data transmission line pass. The receiving amplifier which receives, amplifies and outputs the sent frequency-hopping signal, The receiving-side frequency deviation circuit which an opposite direction is made to carry out frequency deviation of the frequency of the output signal of this receiving amplifier to the frequency deviation by the frequency-hopping signal generation sending-out section of the aforementioned transmitter, and generates a received intermediate frequency signal, The data demodulator circuit which restores to the aforementioned received intermediate frequency signal, and outputs recovery data, The data stream sequence restoration circuit which the data stream recombination sexagenary cycle by the data stream sequence recombination circuit of the aforementioned transmitter rearranges the sequence of the train of the aforementioned recovery data to an opposite direction, restores in order of the data stream before the data stream recombination by the aforementioned data stream sequence recombination circuit, and is outputted, A receiver including the error correction circuit which performs error correction processing to the output data of this data stream sequence restoration circuit.

[Claim 2] The frequency-hopping signal generation sending-out section of the aforementioned transmitter is the circuit which makes different hopping frequency of M pieces deviate the frequency of the aforementioned transmitted intermediate frequency signal. When it is the system of the data transfer rate which transmits N continuous data (N is plurality) contained in the aforementioned transmitted intermediate frequency signal during 1 transmitting [by the 1 hopping frequency] The data stream sequence recombination circuit of the aforementioned transmitter divides an input data train into the group of every M data one by one. these N divided groups as one unit of data stream sequence recombination The frequency-hopping transmission system according to claim 1 which is the circuit which takes out at a time from each group of these one units [N] one by one one data in sequence in the order of a group defined beforehand, and the group defined beforehand, arranges, and is made into the data stream after sequence recombination.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention belongs to the frequency-hopping transmission system which transmits data, deviating a transmission frequency about a frequency-hopping transmission system according to the frequency-hopping pattern defined especially beforehand.

[0002]

[Description of the Prior Art] Into a data transmission system, some frequency in a use frequency band is used, and there is a frequency-hopping transmission system which performs data transmission, deviating these frequency one by one according to a predetermined pattern. The block diagram of a conventional typical example of this frequency-hopping transmission system is shown in drawing 4 (a) and (b). These details of the frequency-hopping transmission system of this example are as follows including transmitter 10x and receiver 20x. The error correction control processing section 12 which transmitter 10x process error correcting code-ization etc. to the data DTi inputted as the input circuit 11 which inputs Data DTi one by one, and is outputted, The data modulation circuit 14 which generates the transmitted intermediate frequency signal IFt modulated by the output data of this error correction control processing section 12, The transmitting-side frequency deviation circuit 15 which the frequency of a radio frequency band is deviated based on the transmit-frequencies hopping pattern signal FHPT which specifies the transmitted intermediate frequency signal IFt to be the hopping pattern set up beforehand, and generates and outputs the frequency-hopping signal FHS, The signal sending-out section 16 emitted from an antenna 17 by making the frequency-hopping signal FHS into an electric wave, It has the composition of having transmission-control section 18x which control processing operation of the error correction control processing section 12 and the data modulation circuit 14, and output the frequency-hopping pattern signal FHPT and control processing operation of the transmitting-side frequency deviation circuit 15.

[0003] Moreover, the receiving amplifier 22 which receiver 20x receive the electric wave sent from transmitter 10x, receives the frequency-hopping signal FHS with an antenna 21, amplifies, and is outputted, The frequency of the frequency-hopping signal (FHS) from this receiving amplifier 22 The receiving-side frequency deviation circuit 23 which an opposite direction is made to carry out frequency deviation to the frequency deviation at the time of transmission, and generates the received intermediate frequency signal IFr based on the received-frequency hopping pattern signal FHPr, The data demodulator circuit 24 which carries out recovery processing of the received intermediate frequency signal IFr, and outputs the recovery data DMD, The error correction circuit 26 which performs error correction processing to the recovery data DMD, and reproduces data, The output circuit 27 which amplifies the data from this error correction circuit 26, and is made into output data DTo, It has the composition of having reception-control section 28x which output the received-frequency hopping pattern signal FHPr, and control processing operation of the receiving-side frequency deviation circuit 23, and control processing operation of the data demodulator circuit 24 and the error correction circuit 26.

[0004] An example of the frequency-hopping pattern used among these transmitter 10x and receiver 20x and the example of data to transmit are shown in drawing 5. The frequency which carries out the hopping of the frequency-hopping pattern of this example, and can be taken Those with 8 frequency from f1 to f8, When (the hopping pattern period Thp) is divided into the eight sections and the turn number (henceforth a hopping number) accompanying progress of Time t is given to the these 8 section with H1, H2, ..., H8, the period of one hopping pattern frequency serves as f2, f4, f6, f8, f1, f3, f5, f7, and a pattern to deviate in order of these hopping numbers H1, H2, ..., H8 (namely, time progress -- following) And the data to transmit, for example, a "Japanese alphabet", are assigned one by one to the hopping numbers H1 and H2 and accompanying time progress, and it transmits as an electric wave. [..]

[0005] Though frequency f3 has disturbance and interference in this case, and the data (**) of the portion are no longer

transmitted to receiver 20x or are transmitted accidentally, if the data of the circumference are transmitted normally, the whole data is reproducible by the error correction circuit 26. Although this example showed the example which assigns and carries out data transmission of the one data to 1 transmitting period by one frequency, there is also an example which adopts the high-speed FH method which is made to carry out the hopping of the one data to two or more frequency, and transmits it to it so that reproduction of data can be performed more certainly. However, in order to switch frequency and to transmit data normally, a limitation is in the toggling speed, and it is unsuitable for the quick data transmission of a data transfer rate. When making quick the case where a data transfer rate is quick, and a data transfer rate, it is necessary to assign and transmit two or more data which continue during 1 transmitting [by one frequency].

[0006]

[Problem(s) to be Solved by the Invention] In order to carry out frequency hopping and to transmit data normally in the conventional frequency-hopping transmission system mentioned above Since a limitation is in the frequency toggling speed, when performing quick data transmission of a data transfer rate, as it is necessary to assign and transmit two or more data which continue during 1 transmitting [by one frequency] and is shown in drawing 6 For example, for disturbance or interference, if frequency f3 is transmitted accidentally [transmit / the data of the portion / to the receiver 20x side] In order that the continuous data of plurality (if it is " in the example of drawing 6 4 of *****") may remove, it becomes impossible to reproduce the data of the portion exceeding the limitation of an error correction function, and there is a trouble of transfer of the right information becoming impossible.

[0007] The purpose of this invention is [to make quick the case where a data transfer rate is quick, or a data transfer rate, in view of the trouble of the above-mentioned conventional technology] to offer the frequency-hopping transmission system which the repeatability of data in case there are disturbance and interference can be raised, and can transmit information correctly.

[0008]

[Means for Solving the Problem] The frequency-hopping transmission system of this invention is a frequency-hopping transmission system which the hopping frequency from which plurality differs according to the hopping pattern which was able to be defined beforehand is made to deviate the frequency of the signal which carries out data transmission one by one, and carries out data transmission to it, and in order to attain the above-mentioned purpose, it is characterized by having each following composition.

(b) The error correction control processing section which performs and outputs error correction control processing of the transmitting side beforehand defined to the inputted data stream, This data stream the sequence of the data stream outputted from this error correction control processing section the account of before The data stream sequence recombination circuit rearranged and outputted so that it may be distributed to the hopping frequency from which the data with which the number of different hopping frequency and the same number continue differ mutually, The data modulation circuit which generates the transmitted intermediate frequency signal modulated by the output data of this data stream sequence recombination circuit, The frequency-hopping signal generation sending-out section which two or more aforementioned hopping frequency is made to deviate the frequency of the aforementioned transmitted intermediate frequency signal one by one according to the aforementioned hopping pattern, generates a frequency-hopping signal, and is sent out to the data transmission line, The receiving amplifier which receives, amplifies and outputs the frequency-hopping signal sent through the ***** transmitter (b) aforementioned data transmission line, The receiving-side frequency deviation circuit which an opposite direction is made to carry out frequency deviation of the frequency of the output signal of this receiving amplifier to the frequency deviation by the frequency-hopping signal generation sending-out section of the aforementioned transmitter, and generates a received intermediate frequency signal, The data demodulator circuit which restores to the aforementioned received intermediate frequency signal, and outputs recovery data, The data stream sequence restoration circuit which the data stream recombination sexagenary cycle by the data stream sequence recombination circuit of the aforementioned transmitter rearranges the sequence of the train of the aforementioned recovery data to an opposite direction, restores in order of the data stream before the data stream recombination by the aforementioned data stream sequence recombination circuit, and is outputted, A receiver including the error correction circuit which performs error correction processing to the output data of this data stream sequence restoration circuit [0009] Moreover, the frequency-hopping signal generation sending-out section of the aforementioned transmitter is the circuit which makes different hopping frequency of M pieces deviate the frequency of the aforementioned transmitted intermediate frequency signal. When it is the system of the data transfer rate which transmits N continuous data (N is plurality) contained in the aforementioned transmitted intermediate frequency signal during 1 transmitting [by the 1 hopping frequency] The data stream sequence recombination circuit of the aforementioned transmitter divides an input data train into the group of every M data one by one. these N divided groups as one unit of data stream sequence recombination It takes out one data at a time from

each group of these one units [N] one by one in sequence in the order of a group defined beforehand, and the group defined beforehand, arranges, and has the composition which is the circuit made into the data stream after sequence recombination.

[0010]

[Embodiments of the Invention] The gestalt of 1 operation of this invention the sequence of the data stream which goes into a data modulation circuit at a transmitter side Prepare the data stream sequence recombination circuit rearranged so that it may be distributed to the hopping frequency from which the data with which the number of hopping frequency used by this system of this data stream and the same number continue differ mutually, and it sets to a receiver side. It has the composition of having prepared the data stream sequence restoration circuit which rearranges the sequence of the data stream to which it restored by the data demodulator circuit to an opposite direction with a transmitter side, and is restored to the same sequence as the data stream before the recombination by the side of a transmitter. In order that a data transfer rate may be quick and may make a data transfer rate quick by considering as such composition When transmitting two or more data during 1 transmitting [by 1 hopping frequency], though the data of the portion remove in response to disturbance or interference, a certain hopping frequency Since this removed data is distributed by the homogeneity in the data stream when the sequence of a data stream is restored by the receiver side, the removed data can also be reproduced by the error correction circuit, and information can be transmitted correctly.

[0011]

[Example] Next, the example of this invention is explained with reference to a drawing. Drawing 1 (a) and (b) are the block diagrams of the transmitter in which one example of this invention is shown, and a receiver. The point that this example is different from the conventional frequency-hopping transmission system shown in drawing 4 (a) and (b) As opposed to conventional transmitter 10x between the error correction control processing section 12 and data modulation circuit 14 The sequence of the data stream outputted from the error correction control processing section 12 This data stream, The data stream sequence recombination circuit 13 which rearranges so that it may be distributed to the hopping frequency from which the data with which the number of the hopping frequency in this system and the same number continue differ mutually, and is outputted to a data modulation circuit is formed. And add the processing moving control function of this data stream sequence recombination circuit 13 to transmission-control section 18x, and it considers as a transmitter (the transmission-control section after this functional addition is 18) 10. As opposed to conventional receiver 20x between the data demodulator circuit 24 and error correction circuit 26 The recombination sexagenary cycle of the data stream by the data stream sequence recombination circuit 13 of a transmitter 10 rearranges the sequence of the data stream outputted from the data demodulator circuit 24 to an opposite direction. The data stream sequence restoration circuit 25 which restores to the same sequence as the data stream before the data stream recombination by the data stream sequence recombination circuit 13, and is outputted to the error correction circuit 26 is formed. And it is in the point which added the processing moving control function of this data stream sequence restoration circuit 25 to reception-control section 28x, and was used as the receiver (the reception-control section after this functional addition is 28) 20.

[0012] Next, drawing 2 is collectively referred to about sequence recombination operation of a data stream by the data stream sequence recombination circuit 13, and it explains concretely. First, "the data stream outputted from the error correction control processing section 12 and its sequence are to ** in a Japanese alphabet", and presuppose that it is the system of the data transfer rate which transmits every four of this data stream by one transmission by 1 hopping frequency (1HF). In this case, the data stream sequence recombination circuit 13 divides the data stream before recombination into the group of every data 8 piece (8 is the number of hopping frequency) one by one (Group A, Group B,). These four divided groups (the number of the data transmitted by the 1 transmission by 1HF as the above [4]) as one unit of data stream sequence recombination The order of a group beforehand defined at a time one data from each group (Group A - Group D) of these one units [four] (in the example of drawing 2) They are [Groups A, B, C, and D and] the order of this repeat, and the data sequence in a group (in the example of drawing 2) below. the order A of an array in each group, i.e., a group, -- "-- it is, and in order, it takes out one by one, arranges, and outputs to ** and ** as a data stream "it is needed and ***** stretches .." after [....] rearranging sequence Thus, however the hopping pattern (FHPT) in the transmitting-side frequency deviation circuit 15 may change by rearranging, eight data with which the data stream before recombination continues will come to be assigned to hopping frequency which is surely mutually different.

[0013] drawing 3 is drawing for explaining whether the hopping frequency f3 of the frequency-hopping signals transmitted from the transmitter 10 receives with a receiver 20, when the data (since -- **) of the portion are missing in response to disturbance and interference, and the data stream after data stream sequence restoration will be in what state data "which the data stream to which it restored by the data demodulator circuit 24 is "it is needed and

***** stretches", and was transmitted on the hopping frequency f3 of this data stream -- since -- "*" is missing this -- a data stream -- sequence -- restoration -- a circuit -- 25 -- the -- sequence -- rearranging -- origin -- sequence -- returning -- if -- drawing 3 -- a bottom -- like -- having been missing -- data -- "-- ** -- " -- "-- it is -- " -- "-- ** -- " -- "-- ** -- " -- restoration -- the back -- a data stream -- uniform -- distributing -- having -- since -- having been missing -- a portion -- data -- an error correction circuit -- easy --

[0014] In this example, since sequence recombination of a data stream brings the same result as having replaced the sequence of the frequency by the frequency-hopping pattern by the transmitting-side frequency deviation circuit 15 in assigning one data in 1 transmitting period by one frequency, it becomes the same thing as having only changed the hopping pattern to another pattern.

[0015] Namely, since the data transfer rate of this invention is quick, when two or more data need to be transmitted during [one] 1 transmitting [of hopping frequency], even if a certain frequency receives disturbance and interference A data transfer rate can be made quick, transmitting [can transmit information correctly, and] information correctly, even if there are disturbance and interference during [one] 1 transmitting [of hopping frequency], as two or more data are transmitted.

[0016] [Effect of the Invention] As explained above, this invention the sequence of the inputted data stream by the transmitter side After rearranging so that it may be distributed to the hopping frequency from which the data with which the number of hopping frequency used by this system of this data stream and the same number continue differ mutually, it sends out as a frequency-hopping signal. by the receiver side Since the data transfer rate is quick, when two or more data need to be transmitted during [one] 1 transmitting [of hopping frequency] by considering as the function to return the sequence of the sent data stream Since the data of the portion of opposite *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne. can be uniformly distributed to the data stream which restored sequence even if a certain hopping frequency receives disturbance and interference, the repeatability of data can improve and information can be transmitted correctly. Moreover, it is effective in the ability to make a data transfer rate quick, transmitting information correctly, even if there are disturbance and interference during [one] 1 transmitting [of hopping frequency], as two or more data are transmitted.

[Translation done.]

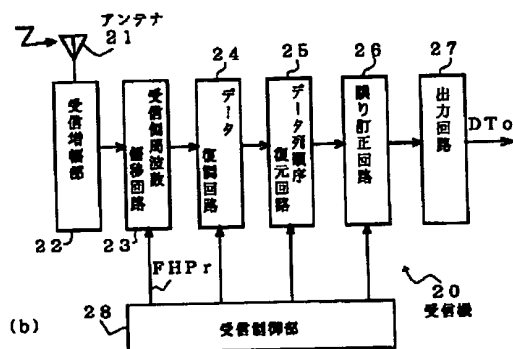
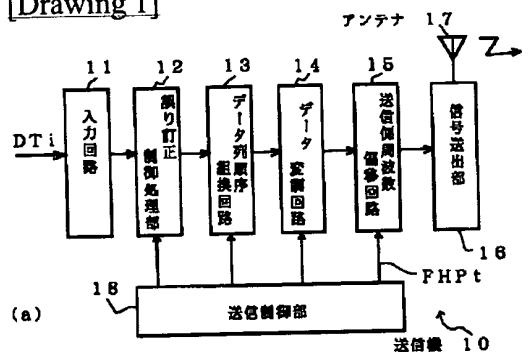
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

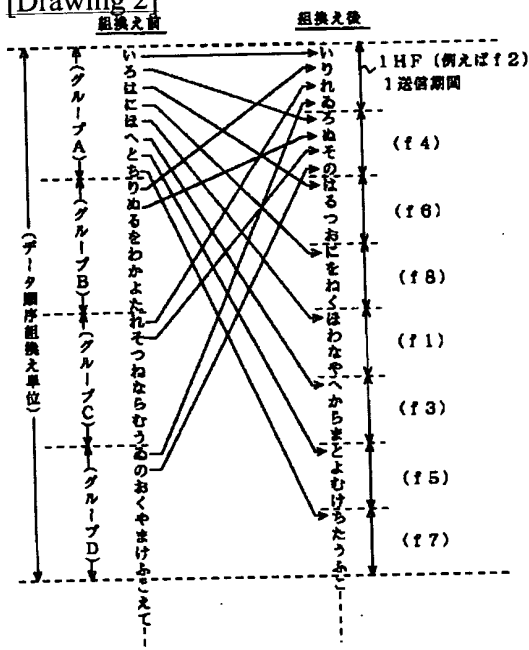
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

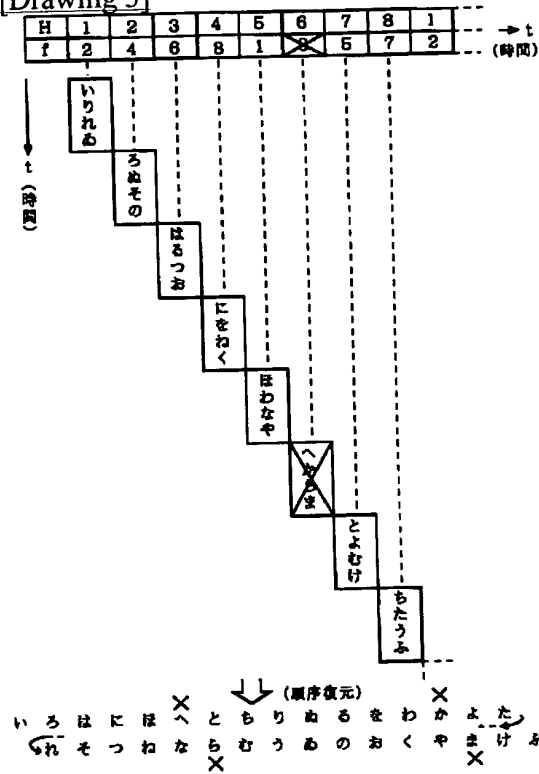
[Drawing 1]



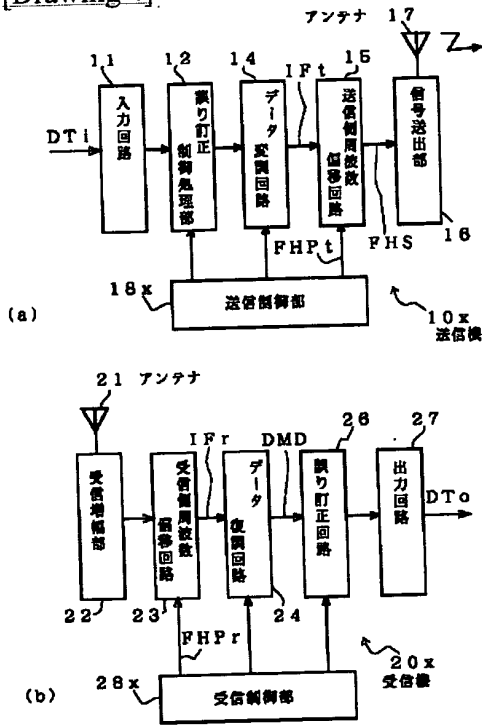
[Drawing 2]



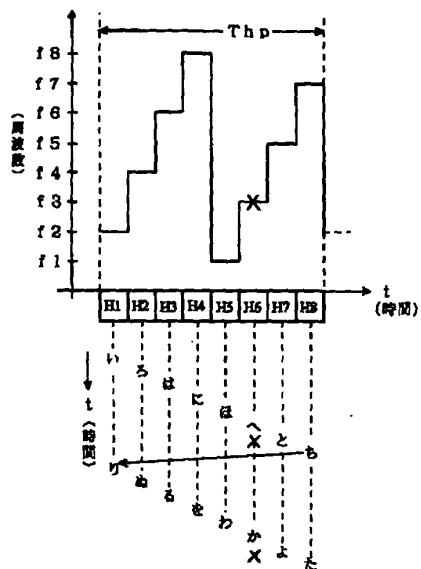
[Drawing 3]



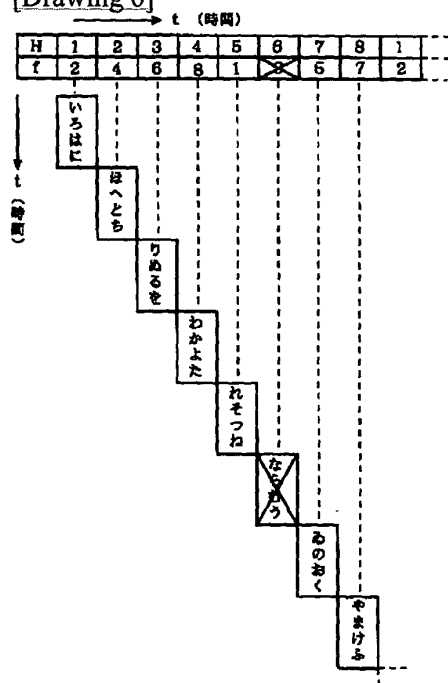
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]